20. Potential Benefits Of Product Lifecycle Management (PLM) 2.0 Social Networking Capabilities Within MBSE

Axel Reichwein[1] and Shaunak Hemant Shroff[2]
[1]KONEKSYS and [2]MEMKO

Abstract

The reuse of Web 2.0 concepts in the context of product development has been coined "PLM 2.0". Its goal is to facilitate and enhance the collaboration between engineers, end users and project managers. PLM 2.0 provides a transparent communication platform for knowledge sharing and knowledge creation between communities which were previously disconnected such as engineers and end users. As a result, all stakeholders can take a more active role during product development. Clients and end users can for example easily follow the design evolution and verify that their design intent is being met.

As of now, PLM 2.0 concepts have been embedded in engineering software applications such as CAD and PLM systems as well as in Microsoft Office documents. However, many products are increasingly composed of software and electronics which require other design representations than plain 3D models and documents. For instance, a system architecture description is particularly useful in complex systems design to represent at a high level of abstraction the main system components and interactions. Multiple stakeholders from different disciplines as well as the clients and end users can then better identify interface issues and design change impacts.

The paper provides a brief introduction to PLM 2.0 concepts with respect to social communication and explores some of the key features. It further delves into usage scenarios of PLM 2.0 technology and explores the benefits of such technology in a general perspective of the company. More specifically, an example of using PLM 2.0 in early stages of Systems Engineering activities and usage across a SysML example is explored.

The Systems Modelling language (SysML) is increasingly used in Model-Based Systems Engineering (MBSE) to define the system architecture, requirements, functions, use cases and behaviour and cross-cutting dependencies. This article investigates the potential benefits of supporting PLM 2.0 social networking capabilities within a SysML modelling environment in order to improve: the collaboration between clients/end users and system engineers, the communication between system engineers and engineers from other disciplines, the traceability and consistency between design representations at multiple abstraction levels including requirements, system architecture, PLM, CAD and simulation models.

Since the human factor is critical in reaching PLM 2.0 benefits, criteria are listed to enable social computing to reach its fullest potential within the systems engineering community. Two major factors are critical for the success of social technologies in engineering: company culture and communicative engineers. Without a company culture facilitating and encouraging healthy discussion, engineers will not use PLM 2.0. In addition, the value of PLM 2.0 relies on clear and qualitative contributions from engineers. The communication skills of engineers will therefore become more important as social technologies are increasingly adopted.

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14. ABSTRACT
The reuse of Web 2.0 concepts in the context of product development has been coined âPLM 2.0â. Its goal is to facilitate and enhance the collaboration between engineers, end users and project managers. PLM 2.0 provides a transparent communication platform for knowledge sharing and knowledge creation between communities which were previously disconnected such as engineers and end users. As a result, all stakeholders can take a more active role during product development. Clients and end users can for example easily follow the design evolution and verify that their design intent is being met.

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Presenter Biographies

Axel Reichwein received a PhD in Aerospace Engineering from the University of Stuttgart focusing on multidisciplinary system modelling, data integration, and model-driven system configuration using the Unified Modelling Language (UML). Pursuing his research interests, Dr. Reichwein continued as a Postdoctoral Research Associate at the Georgia Institute of Technology with Dr. Chris Paredis focusing on the Systems Modeling Language (SysML). His research was sponsored by Siemens, United Technologies, John Deere, Ford Motor Company, and DARPA.

During his PhD and Post-doctorate research, he implemented several model transformations between UML/SysML and discipline-specific models (CAD: CATIA, SolidWorks, VRML; Dynamic System Simulation: Simulink, SimMechanics, Modelica; Mathematical Solvers: MATLAB, Mathematica, GAMS; Other: Excel). These model transformations were implemented using standard programming languages such as Java as well as new emerging model transformation languages such as Query/View/Transformation (QVT).

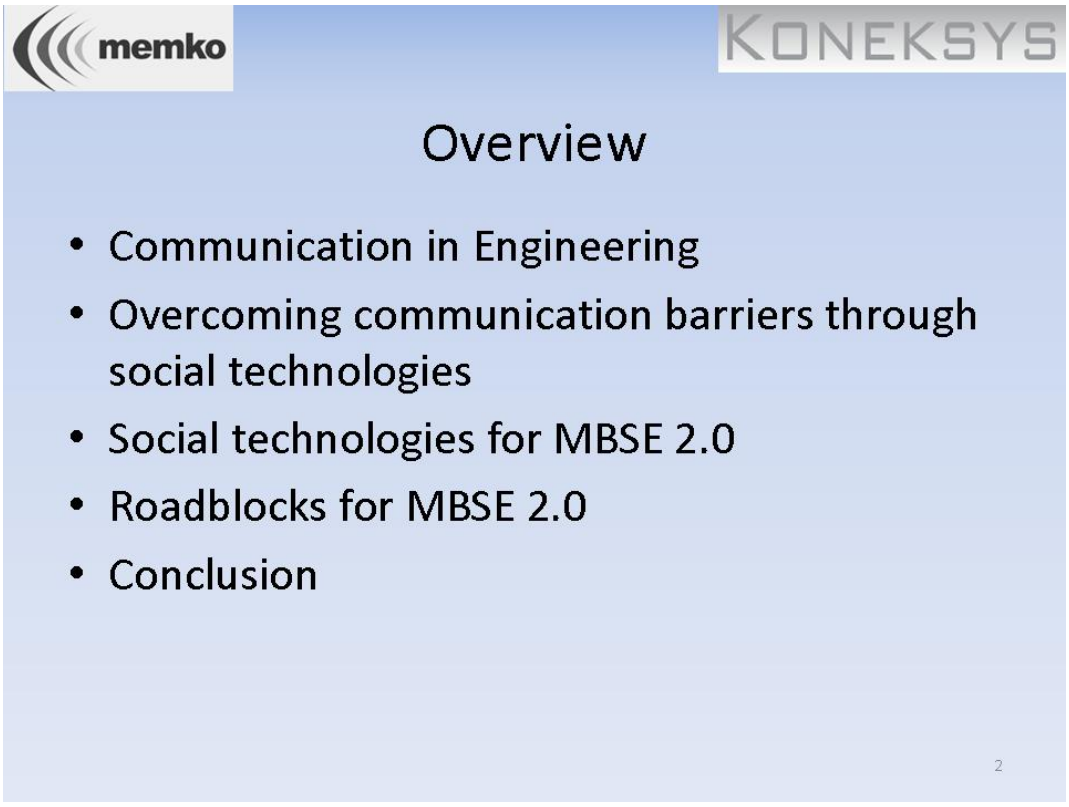
Axel Reichwein also actively participated in the Object Management Group (OMG) by chairing the OMG SysML-Modelica project and by contributing to the Systems Modelling Language (SysML) working groups.

Shaunak Hemant Shroff completed a Bachelor of Engineering (Mechatronics) and Bachelor of Computer Science from the University of Melbourne with first class honours. He developed a model based Simulink Architecture in order to define the behaviour of the Sumo Robot. The Sumo Robot won two competitions (held in Melbourne and Sydney).

He works for Memko Pty Ltd. which is a value-added reseller of Dassault Systemes' Product Lifecycle Management (PLM) software and is well versed in using Systems Engineering software such as CATIA V6 Systems, Dymola, ControlBuild and Rectify. As a certified V6 Foundations User, he has the knowledge on the basis and concepts of the PLM 2.0 architecture and its impact on the Systems Engineering Software.

He has had also some experience in integrating Dassault Systemes software with other third party software through the usage of the inbuilt scripting functionalities.

Presentation



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Examples of communication failures

- Companies that design complex, highly engineered products all have their horror stories. Ford and Bridgestone Firestone lost billions of dollars after their failure to coordinate the vehicle design of the Ford Explorer with the design of its tires. Similarly, Airbus's development of the A380 "superjumbo" suffered major delays and cost overruns because of late emerging incompatibilities in the design of the electrical harnesses of various sections of the plane's fuselage. These mistakes probably contributed to the loss of Airbus's CEO and to important changes in the management of the A380 program.
- What's striking about these stories and many others like them is that in virtually every case, the people involved all agreed, in hindsight, that they could have avoided their expensive mistakes by making sure that the different teams responsible for developing the products' components had communicated more effectively. Of course with complex development projects, you can never be certain that you have planned for every contingency. However, our experience shows that in the design phase of such projects, many companies would benefit from focusing sharply on the critical points of contact among their various component development teams to ensure that everyone knows when and with whom they should be sharing information.

For example based on documentation such as this slide!

3

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Communication in Engineering

- Importance of Communication
  - Engineering is about making good decisions
  - Engineered systems are becoming complex
- Communication barriers :
  - Ineffectiveness of the current communication channels;
  - Restrictions on expressiveness imposed by notations; and
  - Social and organisational barriers.

4

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How can social technologies break communication barriers?

- Taking advantage of social Web 2.0 –based technologies
  - It becomes easier for everyone to connect with everyone
  - Harvesting collective intelligence
  - Making communication more transparent and easier
  - Adding context to the discussion thread (not just a simple forum)

- Web 2.0 Examples
  - Amazon user reviews
  - Wikipedia articles
  - Facebook
  - Twitter

Social technologies applied to Engineering: PLM 2.0!

5

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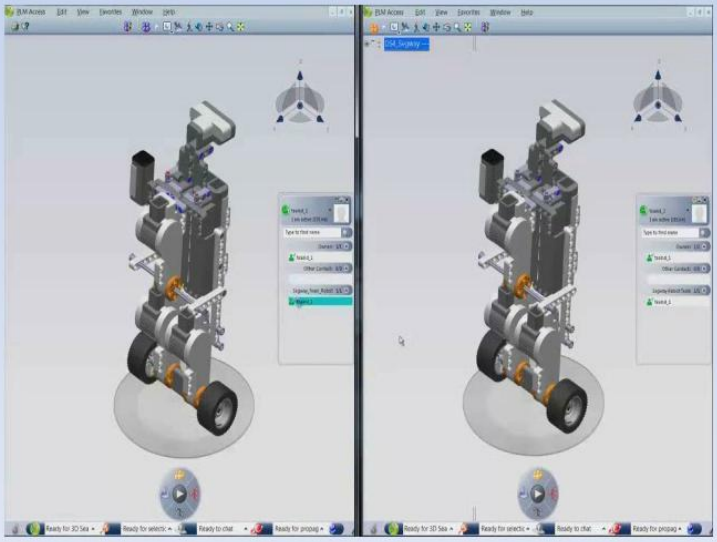
PLM 2.0 Example



6

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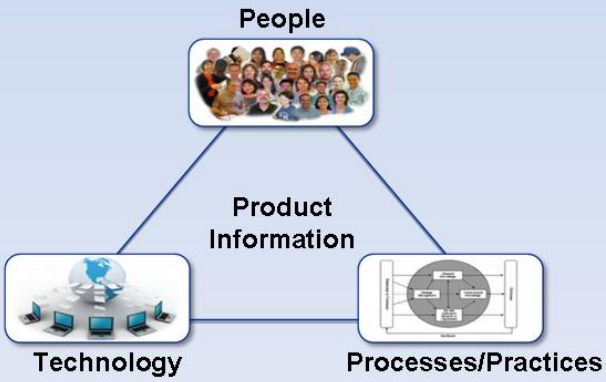
PLM 2.0

PLM (Product Lifecycle Management) is a concept/technology that centers around product development from conception to completion.



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PLM 2.0 Features

- Instant Collaboration in real-time
- Distribution of information to right channels
- Adopts web services architecture
- Use of 3D models for communication
- Data Interoperability
- On demand access to data - searchability

8

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PLM 2.0 Usage Scenarios

- Start a discussion thread related to a model feature
  - Ask product developement questions
  - Get help on design issues
  - Solicit feedback from a broad or narrow audience
  - Ask for clarification on a specific feature
  - Make suggestions
  - Propose fixes
- Participate in a discussion
  - Participate in brainstorming activities
  - Give feedback
  - Share best practices

9

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PLM 2.0 Benefits

- More transparent communication
- Ensuring decision making and process information is readily communicated
- Less time spent in meetings
- Better understanding of the history leading to a decision
- Benefits of Service Oriented Architecture

PLM 2.0 for Model-Based Systems Engineering?

10

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Systems Engineering Activities

- Identify project context and goals
- Identify stakeholders
- Identify functions/features/use cases/requirements
- Identify system components
- Identify component interfaces and interactions
- Identify analysis to be performed
- Identify variation points

All activities require many interactions between many stakeholders !

11

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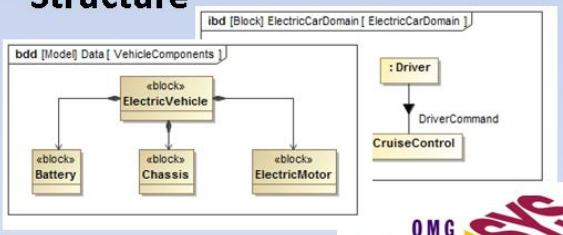
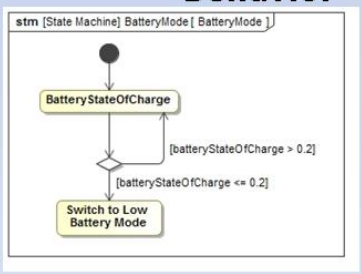
Model-Based Systems Engineering

Structure

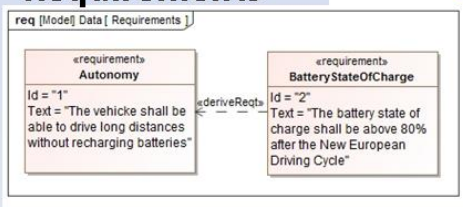


Behavior

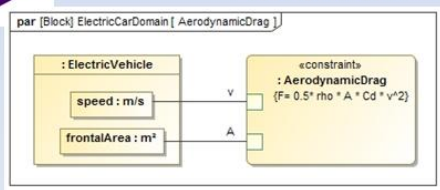


OMG SYSTEMS MODELING LANGUAGE SysML™

Requirements



Parametrics



12

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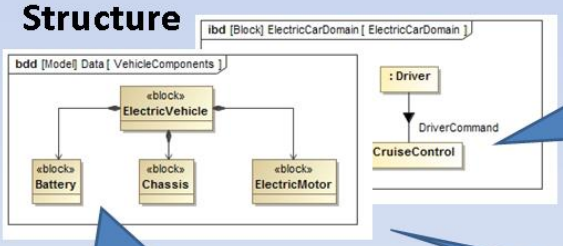
Additional „Social“ Usage Scenarios in MBSE

Structure



Request further detail/granularity about a SysML model feature (e.g. to add more clarity)

Request different SysML model structure to support more modularity and reusability (e.g. change the hierarchical structure of SysML packages or blocks)

Discuss about the pros/cons of different SysML modeling styles (e.g. SysML instances vs. Block generalization)

13

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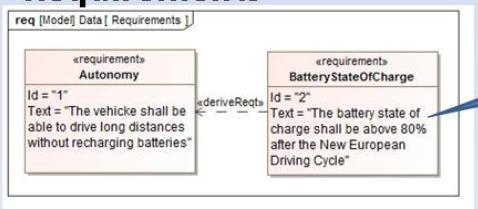
Additional „Social“ Usage Scenarios in MBSE

Question the value of a SysML diagram (e.g. to avoid modeling just for the sake of modeling)

Request references to further documentation on a SysML feature (e.g. Word document)

Requirements



14

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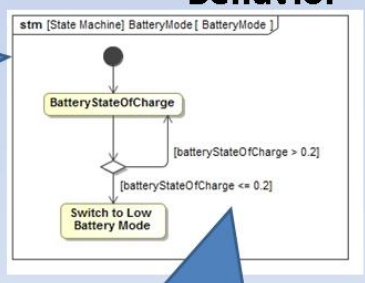
Additional „Social“ Usage Scenarios in MBSE

Consider a snapshot of the SysML model (e.g. specific version) and use it as a basis for review



Request clarification on the meaning of a SysML concept (e.g. new SysML 1.3 concepts)

15

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Benefits of an Integrated Social Engineering Platform

- Ideally, all engineering tools should support social interactions through a common collaboration platform
- Discussion threads can have a hashtag like in Twitter
- Harness „wisdom of the crowds“
- Tool interoperability

http://www.youtube.com/watch?feature=player_embedded&v=bfpdUf9gsuc

16

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Roadblock for „Social“ Engineering: #1 Company Culture

- Social culture of discussions in engineering
- Cost of setting up and maintaining infrastructure
- Resistance to adopt new technology
- Requirement to adhere to current process, tools, methods
- Fear of leaked Intellectual Property

17

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Roadblock for „Social“ Engineering: #2 Anti-social Engineers

- Engineers typically do not have the best communication skills
- Engineers from different streams find it hard to communicate with each other and with non technical personnel
- Engineers often fail to express their point of view

18

Conclusion

- Big potential for MBSE
- But current roadblocks, (e.g. company culture) needs to be overcome, need a paradigm shift
- Current demands of industry require a service oriented approach (consumer centric)

19

CONTACT US

AXEL REICHWEIN
CEO, KONEKSYS MEMKO
axel.reichwein@koneksys.com
+1 404-549-8100

SHAUNAK SHROFF
PLM ENGINEER,
shaunak@memko.com.au
+61 427 288 304

20

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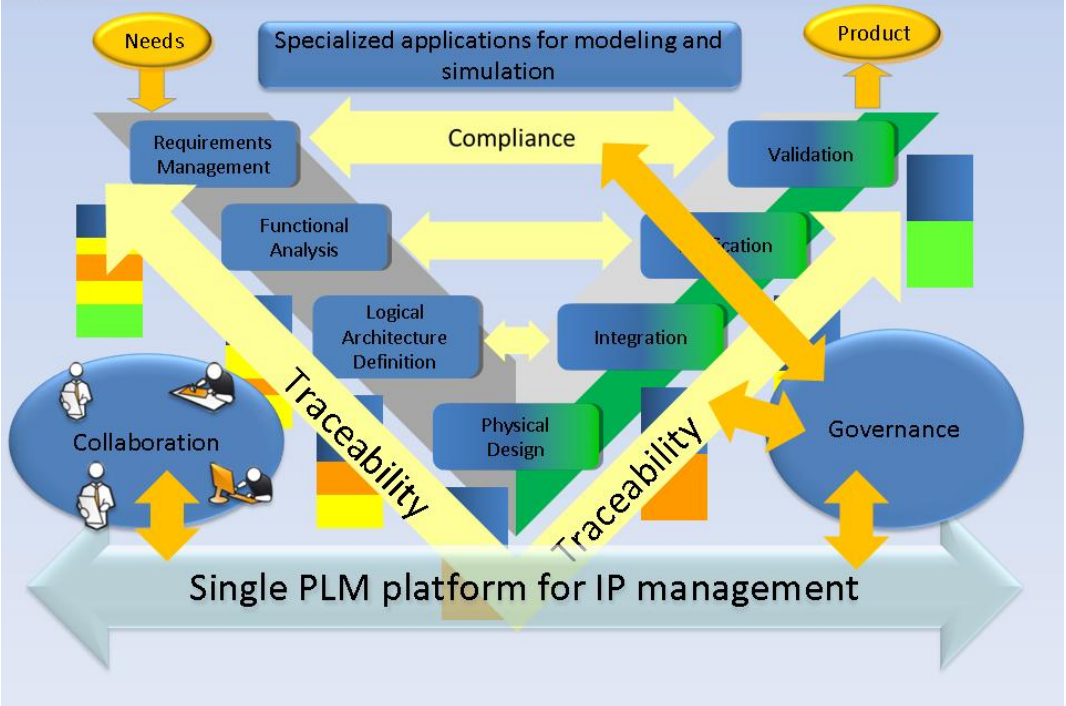

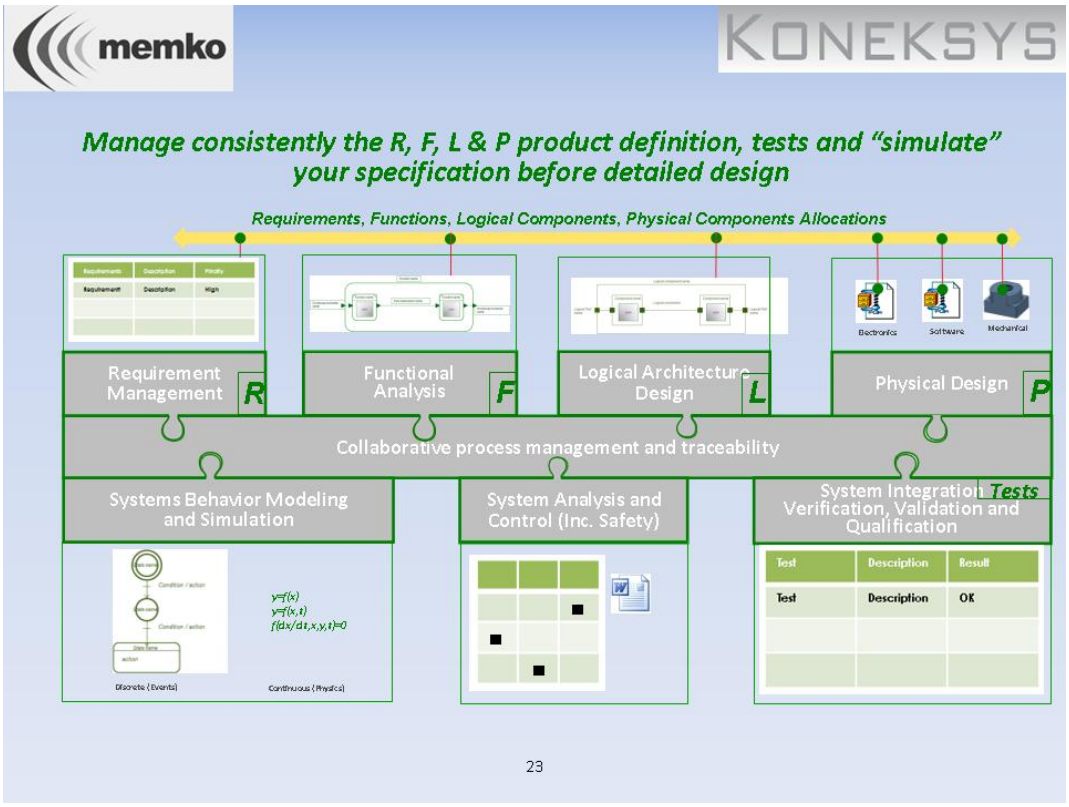
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Manage consistently the R, F, L & P product definition, tests and "simulate" your specification before detailed design
Requirements, Functions, Logical Components, Physical Components Allocations
Requirement Management
R
Functional Analysis
F
Logical Architecture Design
L
Physical Design
P
Collaborative process management and traceability
Systems Behavior Modeling and Simulation
System Analysis and Control (Inc. Safety)
System Integration Verification, Validation and Qualification
Tests
Test
Description
Result
Test
Description
OK
y=f(x)
y=f(x,t)
f(dx/dt,x,y,t)=0
23